Control of Gene Expression

Reference: pp. 255-258

For many genes, the frequency of their expression must be controlled (e.g., turned on and off). Why?

Gene expression may be controlled:
-at transcription
-after transcription (changes to mRNA in the nucleus)
-by the rate of translation
-after translation during protein activation

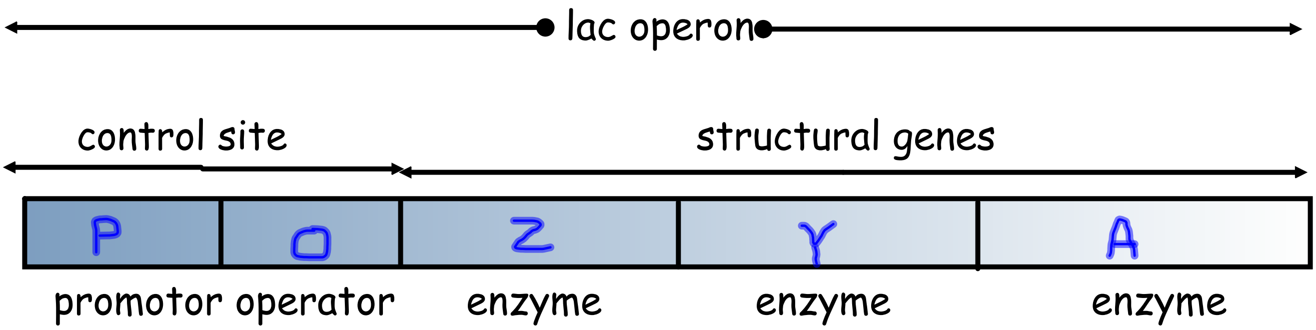
Control Mechanisms in Prokaryotes

In bacteria, many genes are clustered in units called **operons**. Researchers have studied the operon for three genes in E. coli that are responsible for enzymes (e.g., β-galactosidase) involved in lactose breakdown. It is called the lac operon.

↳ lactose

The transcription of genes in an operon is blocked by **repressor proteins** (lacI protein in this case) and activated by **inducer proteins**. These proteins bind to a section of the operon called an **operator**.

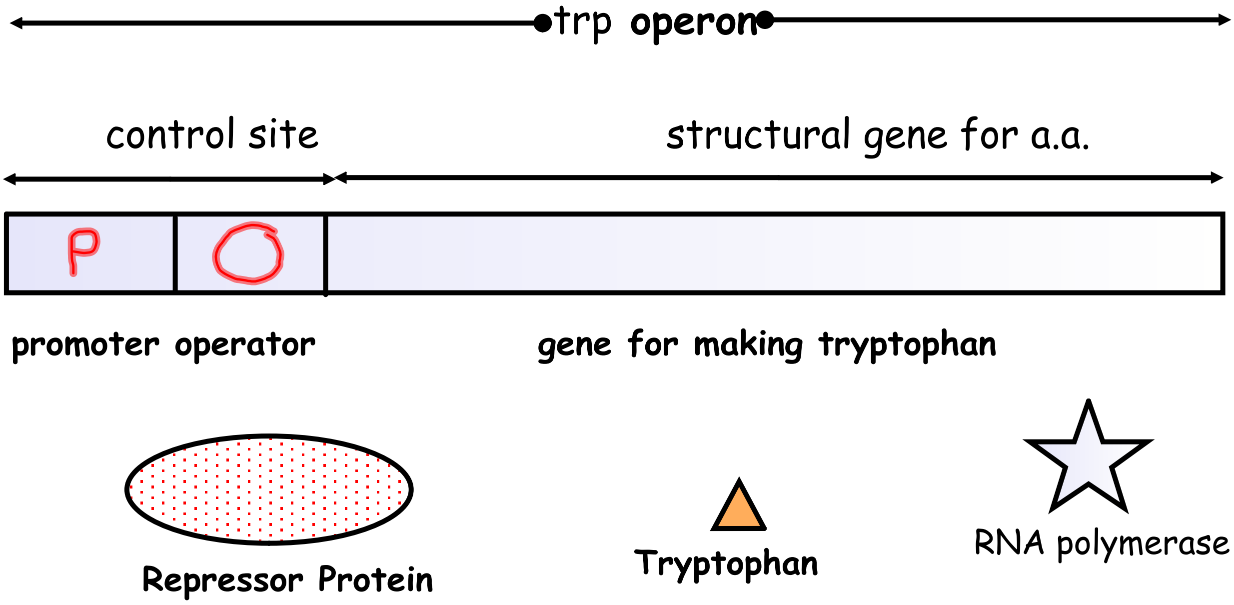
Map of the lactose operon and its regulator gene.



When lactose levels are high, B-galactosidase must be produced. Lactose acts as the **inducer** and binds to the repressor protein (LacI protein), changing it's shape (conformation) and causing it tc detach from the operator. RNA polymerase can now bind to the promoter region and begin transcription.

So, lactose breakdown needs to be controlled. However, E. coli requires a constant supply of some amino acids, including tryptophan. The operons for the synthesis of a.a.'s are regulated only under very high a.a. concentrations. The trp operon is repressed only under very high tryptophan concentrations. Tryptophan binds to the repressor protein, changing its shape, anc allowing it to bind to the operator. In this capacity, tryptophan is called a corepressor.

Map of the lactose operon and its regulator gene.



HW: p. 258, #2, 3, 5, 6